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ALTERNATING ELECTRIC CURRENTS.

- (1) *The Principles of Electrical Engineering and their Application.* By Prof. Gisbert Kapp. Vol. i. Pp. xii+356. (London: Edward Arnold, 1916.) Price 18s. net.
- (2) *A Treatise on the Theory of Alternating Currents.* By Dr. Alexander Russell. Vol. ii. Second edition. Pp. xiv+566. (Cambridge: At the University Press.) Price 15s. net.
- (3) *Alternating Currents in Theory and Practice.* By W. H. N. James. (Cambridge Technical Series.) Pp. vii+353. (Cambridge: At the University Press, 1916.) Price 10s. 6d. net.

THE progress of electrical knowledge and invention is so rapid and the ground covered so extensive that the trend of its literature is for the most part in the direction of books or monographs on special departments of it written by experts. On the other hand, as the existing complete treatises become antiquated or too bulky by additions, the necessity arises for rewriting the subject from a more modern point of view.

(1) The aim of Prof. Kapp's book, the first volume of which is before us, is to furnish the engineering student with a couple of volumes wherein the principles and modern practice of electrical engineering are treated compactly, yet completely, with reference to the needs of the engineer rather than to those of the physicist. Although, for the sake of distinction, we divide engineering into various branches, engineers of all kinds are constantly called upon to use applied electricity in various ways. Thus, a mechanical engineer may have to put up a three-phase motor to work a pump, or a civil engineer may have to lay out an electric tramway system. Hence no one practising any branch of engineering can afford to be ignorant of the principles and methods of electrical engineering. A very commendable feature of Prof. Kapp's book is that the purely mathematical aspect of the subject is kept well under restraint. Such mathematics as is used rarely goes beyond simple algebra or a simple differentiation or integration. This is a distinct advantage, as most engineering students are rather repelled by a book which bristles with mathematical symbols. Again, the verbal explanations are clear and terse, whilst the diagrams have a refreshing air of originality and have not done duty in other books.

The volume under review deals with general principles, and is divided into fifteen chapters. The first six comprise the discussion of electric conduction and resistance, its measurement, and the electrical measurement of current and voltage generally. It would have been better if the connections of the two types of plug Wheatstone's bridge, viz. the series and dial patterns, had been more fully illustrated and described. In the description on p. 20 of the "Thompson double bridge" the name should be "Thomson," as the

late Lord Kelvin was, prior to his peerage, Sir William Thomson. The name is correctly spelt in a previous section on the Thomson-Varley bridge.

The chapter on potentiometric measurements contains much useful information. It seems, however, to be forgotten that the writer of this review was the first person to suggest "setting the potentiometer" by means of a standard cell of known voltage and a divided potentiometer wire, so as to make it a direct-reading instrument. Curiously enough, this method was first described by the writer in a now extinct paper called *Industries* in July and August, 1886, which at that time was edited by Prof. Kapp.

In the section on standard cells (p. 31) the name "Carhard" is a misprint for "Carhart."

Chap. v., on the distribution of continuous currents, contains some valuable information not commonly given in text-books. The analogy between an electric main tapped off at various intervals and a beam loaded at intervals with weights is very instructive, and the application of the same graphical method of solution is suggestive.

Chap. vii. introduces the reader to the principles of electrostatics, and although there is nothing of the nature of great novelty in it, the facts are well set out. Prof. Kapp defines the electrical capacity as the quotient of charge and potential difference. We think that the definition is better given in the form that the capacity is measured by the charge required to raise the conductor to unit potential when all other surrounding conductors are at zero potential.

In some of the formulæ given for capacities the student may perhaps be puzzled by the custom of writing $\ln$ for $\log_e$ or the natural logarithm, and $\lg$ for $\log_{10}$, especially when the letter l appears, as in formula 66 on p. 116, in the same expression for the length of the conductor. Also the decision to employ ϵ for the dielectric constant is not a happy one. This Greek letter has for ages past been consecrated to denote the base of the Napierian logarithms, viz. 2.71828, etc.

Chap. viii., on applied electrostatics, contains much valuable matter of a practical kind, especially on the subject of cable insulation. Chaps. ix. and x. deal with the subject of magnetism and electromagnetism in an interesting manner. There is on p. 162 another little misprint in a proper name in a reference to "Hatfield's" manganese steel. This should, of course, be "Hadfield." Chap. xi. covers elementary electrodynamics, and the information given is kept well in touch with practice, as, for instance, in the remarks on p. 223 on the method of reducing the time constant of motor field circuits. On p. 208, second line, "Lenze's law" should be "Lenz's law."

The last chapter, xv., discusses alternating currents, and gives in compact form most of the necessary information. Altogether the book is one which can be strongly recommended, and we shall look forward with interest to the second volume as likely to contain much of great value

drawn from Prof. Kapp's large practical experience in electrical engineering. The printing and get-up of the book are all that could be desired.

(2) Dr. Alexander Russell's book is of a more theoretical and mathematical character, and is the second edition of the second volume of a treatise on the theory of alternating currents. It appeals therefore to an advanced student or designer who is not averse to full mathematical treatment. A valuable feature of the book is the list of references to other works and papers given at the end of each chapter. The book consists of twenty chapters, covering the full theory of alternators, transformers, induction motors, commutator motors, rotary converters, and electric power transmission by alternating currents. Chap. iii. comprises a very complete discussion of Fourier's theorem and the practical methods of determining the constants in the Fourier expansion. Although chiefly of interest to the pure mathematician, the electrical engineer has frequently occasion to enter this field of analysis. Nevertheless, if much of it has to be done, as in the analysis of tidal curves, then some mechanical means, such as Lord Kelvin's harmonic analyser, would be used.

A very important application of pure mathematics is dealt with in chap. xix., viz. the discussion of the properties of hyperbolic functions and their application in the problem of the long-distance alternating-current power transmission. No electrical engineer concerned with this subject can afford to be ignorant of these modern methods.

Chap. xiv gives a good account of the general theory of induction motors, and chap. xvi of the commutator motor. In this connection we confess we should like to have seen included the theory of Goldschmidt's frequency-raising alternator, now of importance in wireless telegraphy. It has been treated by Pupin as a particular case of asymmetrical rotors in unidirectional magnetic fields. Also another subject of interest in close connection is the use of pairs of static transformers for raising frequency by means of unsymmetrical flux in the cores. The question of the efficiency of this method of frequency raising needs discussion.

It would have been an advantage to include some general description of extra high frequency alternators, such as those of Alexander and the method of frequency raising by alternators in cascade suggested by MM. Latour and Béthénod. Nevertheless, the book as it is is a work of the greatest value to all concerned with alternating-current working, and no advanced student should neglect it.

(3) The third book on our list is of a less ambitious type, but is intended to provide within very moderate compass for the needs of students in universities and technical colleges whose mathematical knowledge is of restricted range. To each chapter is appended a series of examination questions and numerical examples, with the answers in many cases added. The diagrams and

illustrations are in most cases new and well selected.

The chapter on switchgear and protective appliances for high-tension transmission is a particularly useful one, and the diagrams are extremely instructive. The plates at the end showing the modern types of switchgear and panels for handling large currents are valuable.

The book strikes us as very well adapted for second-year students in the electrical engineering departments of our colleges, and as a text-book, from its moderate size and yet thoroughly practical character, it will be popular. It is one of the excellent books in the Cambridge Technical Series edited by Mr. P. Abbott, and the fact that it is printed at the Cambridge University Press is a sufficient assurance that its typography and illustrations are of the very best.

J. A. FLEMING.

THE INFLUENCE OF INTERNAL SECRETIONS ON SEX CHARACTERISTICS.

The Sex Complex: A Study of the Relationships of the Internal Secretions to the Female Characteristics and Functions in Health and Disease. By Dr. W. B. Bell. Pp. xvii + 233. (London: Baillière, Tindall and Cox, 1916.) Price 12s. 6d. net.

DR. BLAIR BELL belongs to that limited group of medical men who resort to the experimental laboratory to extend and verify their means of diagnosis and treatment of clinical conditions. He has given us, under the title "The Sex Complex," observations made in the course of a prolonged inquiry into the nature of the secondary sexual characters of the human body—more particularly the normal and abnormal manifestations of sex in woman. His work will appeal to all who are trying to unravel the obscure and delicate manner in which the sexual system is developed and balanced. From prehistoric times mankind has been familiar with the effects of castration; the effects which followed that operation gave rise to the belief that the sexual characteristics of the male, both mental and bodily, were determined by the testes, while, conversely, feminine characters depended on the ovaries.

The chief aim which Dr. Blair Bell has in view in his present work is to prove that sexual characterisation is the manifestation of a complex glandular system of which the sex-glands form only a part—a system which includes all the glands of internal secretion—the pituitary, the pineal, the thyroid and parathyroids—the thymus, and suprarenal bodies. The normal development of male and female characters depends on the interaction and co-operation of all the members of this complex glandular system; it is in a disturbance of the balance of the various members of the glandular system that Dr. Blair Bell seeks for a rational explanation of the sexual disorders to which so many modern women are liable. Beyond doubt the method of investigation which the author has adopted is one which promises a